

WHAT IS CLAIMED IS:

1. A tube- connecting apparatus having a first holding assembly and a second holding assembly which hold at least two flexible tubes approximately in a parallel state, comprising:

a first pressing unit which is provided at the first holding assembly and which presses the tubes to a flat state;

a second pressing unit which is provided at the second holding assembly and which presses the tubes to a flat state and which is allowed to be located so as to contact the first pressing unit;

a cutting unit which cuts the tubes between the first and second pressing units;

a first movement unit which moves at least one of the first and second holding assemblies to change relatively positions of the tubes cut by the cutting unit such that end portions to be connected face each other; and

a second movement unit which moves at least one of the first and second holding assemblies in a direction that the first pressing unit and the second pressing unit separate and a direction that the end portions to be connected of the tubes cut by the cutting unit contact closely each other.

2. A tube connecting apparatus according to claim 1, further comprising a supporting member which supports at least one of the first and second pressing units such that a pressing amount of the at least one of the first and second pressing units to the tubes changes.

3. A tube connecting apparatus according to claim 2, further comprising a position regulating member which regulates at a predetermined position the at least one of the first and second pressing units supported by the supporting member.

4. A tube connecting apparatus according to claim 2, wherein the first pressing unit has a first engagement portion and the second pressing unit has a second engagement portion, and wherein, when

the at least one of the first and second holding assemblies is driven to move in a direction that the holding assemblies separate from each other by the second movement unit, the supporting member gradually changes the pressing amount of the at least one of the first and second pressing units to the tubes in accordance with a moving amount of the supporting member.

5. A tube connecting apparatus according to claim 4, wherein the first engagement portion and the second engagement portion have a first inclined face and a second inclined face which engage each other, and wherein the first inclined face and the second inclined face slidably contact each other while increasing or decreasing engaging force in proportion to a separated distance between the first and second holding assemblies according to driving of the second movement unit.

6. A tube connecting apparatus according to claim 2, wherein the second movement unit moves the second holding assembly and the supporting member supports the first pressing unit.

7. A tube connecting apparatus according to claim 6, wherein, when the second holding assembly is driven to move in a direction that the second holding assembly is separated from the first holding assembly by the second movement unit, the first pressing unit moves along a length direction of the tubes from a first pressing position where the second holding assembly is located before movement of the second holding assembly starts to a second pressing position while gradually increasing the pressing amount.

8. A tube connecting apparatus according to claim 7, wherein the first pressing unit which is located at the second pressing position presses the tubes with a pressing amount approximately equivalent to a pressing amount of the second pressing unit to the tubes.

9. A tube connecting apparatus according to claim 1, wherein the first holding assembly is driven to move in a first direction

which is a width direction of the tubes by the first movement unit, and the second holding assembly is driven to move in a second direction which is a length direction of the tubes and which intersects the first direction by the second movement unit.

10. A tube connecting apparatus according to claim 9, wherein the first movement unit moves the first holding assembly in the first direction to change relatively positions of the tubes cut by the cutting unit such that the end portions to be connected of the tubes face each other, the second movement unit moves the second holding assembly in the second direction such that the end portions to be connected of the tubes contact closely each other, and wherein a distance between the first pressing unit provided at the first holding assembly which is movable in the first direction and the cutting unit is set to be larger than a distance between the second pressing unit provided at the second holding unit which is movable in the second direction and the cutting unit.

11. A tube connecting apparatus according to claim 10, wherein a moving distance of the first holding assembly in the first direction is set to be larger than a moving distance of the second holding assembly in the second direction.

12. A tube connecting method for cutting and then connecting at least two flexible tubes, comprising the steps of:

pressing the tubes put approximately in a parallel state at a first position on the tubes to deform the tubes to a flat state;

pressing the tubes at a third position on the tubes which is adjacent to the first position to hold the tubes in a flat state;

pressing the tubes at a second position on the tubes which is a position separate from the first position and which is a position opposing to the third position via the first position to hold the tubes in a flat state;

advancing a cutting plate having a predetermined temperature between the second and the third positions to cut the tubes;

moving relatively the tubes which have been cut to face one

end portion and another end portion to be connected of the tubes;
and

evacuating the cutting plate from a predetermined cutting position located between the second and third positions to contact the end portions of the tubes closely each other for connecting the tubes.

13. A tube connecting method according to claim 12, wherein a pressing amount to the tubes is set to be gradually larger corresponding to a change in a pressing position on the tubes from the first position to the second position.

14. A tube connecting method according to claim 13, wherein a pressing amount to the first and second tubes at the second position is approximately equal to a pressing amount to the tubes at the third position.